Bear River Basin


Smiths Fork River near Cokeville

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Watershed Description

Three of the nation's major river systems have their headwaters in Wyoming: the Missouri, Colorado, and Columbia Rivers. In addition, the inland Great Basin has Wyoming headwaters from the Bear River. These watersheds provide a natural basis for delineating aquatic conservation areas. Six major watersheds were identified for conservation planning purposes under this State Wildlife Action Plan (SWAP) using hydrographic boundaries and fisheries assemblage and management considerations (Figure 1). These areas are consistent with the aquatic ecosystems identified for freshwater biodiversity conservation worldwide by Abell et al. (2008). The watershed areas are also synonymous with aquatic zoogeographical units and ecological drainage units identified under The Nature Conservancy's (TNC) hierarchical classification framework (Higgins et al. 2005). The watersheds each include one to four sub-regions (4-digit hydrologic unit code [HUC] watersheds). This approach allows the nesting of multiple spatial and temporal scales for planning and prioritizing conservation actions.

The Bear River basin is based on, and exactly corresponds with, the Bear River hydrologic unit (HUC 1601). It includes two 6-digit HUCs: Upper Bear and Weber (Figure 1). Three 8-digit HUCs and twelve 10-digit HUCs occur partly or wholly within this area. These watersheds span about 1,500 square miles in southwestern Wyoming's Lincoln and Uinta counties. Land ownership is predominantly public, but substantial private land (38%) occurs. The public land is managed primarily by the Bureau of Land Management (40%) and U.S. Forest Service (12%).

The 7,500–sq mi Bear River basin includes portions of northeast Utah, southeast Idaho, and southwest Wyoming. In Wyoming, the basin is simply the Bear River and its tributaries. The Bear River originates in Utah's Uinta Mountains and flows north into Wyoming, crosses back into Utah and then to Wyoming again before exiting into Idaho and its ultimate destination—the Great Salt Lake in Utah. Two major tributaries are the Smiths Fork River and the Thomas Fork River. Other direct tributaries include Yellow Creek, Sulphur Creek, Cottonwood Creek, Twin Creek, and Sublette Creek (Figure 1). From an analysis of the 2010 Version 2.0 National Hydrological Database (NHD) at 1:100,000, there are approximately 1,800 miles of streams in the Bear River basin in Wyoming. This equates to a drainage density of about 1.2 stream miles per square mile land area. About 79% of these stream miles are first or second order streams.

The Wyoming Basins terrestrial-based ecoregion, defined originally by Bailey (1995) and adapted by The Nature Conservancy, occupies most of the Great Basin watershed, but the higher elevations along the periphery coincide with the Utah-Wyoming Rocky Mountain ecoregion. Elevations range from over 10,600 feet in the Wyoming Range in the northeast to 6,050 feet where the Bear River exits the state to flow into Idaho. Except for the Uinta Mountain Range, these landscapes largely do not reflect a glacial history but rather consist of sagebrush plains, floodplain terraces, fertile high elevation valleys along the Bear River and Smiths Fork and Thomas Fork Rivers, sub-irrigated wet meadows (man-made and natural) in those valleys, and the moderately steep slopes of the Wyoming Range and Uinta Mountain Range. The moderate to steep slopes of the Uinta Range contain moraine features and U-shaped valleys (Chapman et al. 2004).

The geology of the region is marked by the uplifted sedimentary overthrust belt of the southern Wyoming Range (Lageson and Spearing 1988). The remaining ridges and valleys are a product of erosion of the folded and faulted sedimentary bedrock. The sedimentary formations are easily eroded and provide surface waters with large volumes of sediments. Furthermore, fine-grained soils and moderate foothill slopes result in streams that are sensitive to disturbance and highly dependent on riparian vegetation for

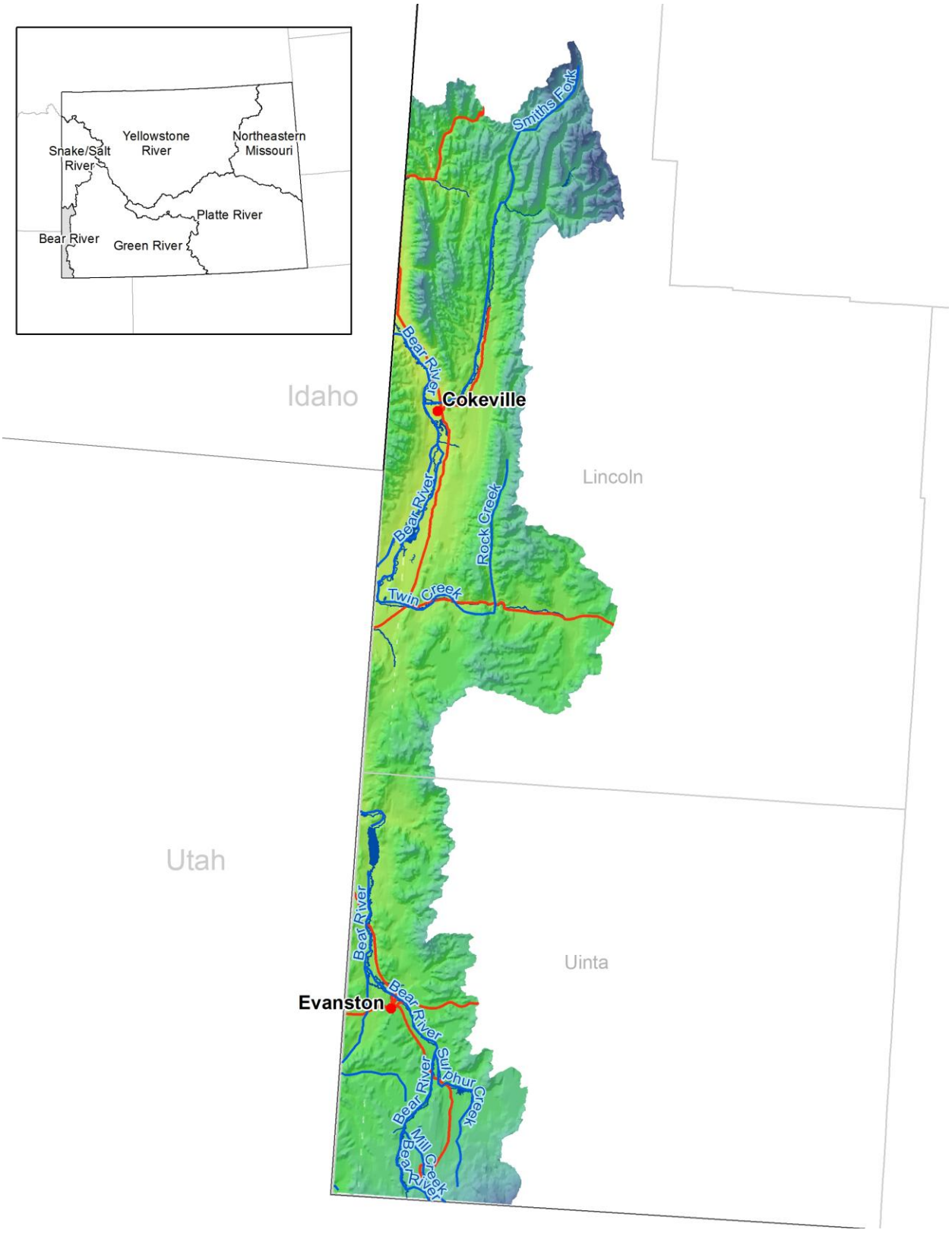

Figure 1. Bear River Basin.

stabilizing stream banks (Wyoming Department of Environmental Quality 2010).

Over geologic history, several large lakes existed here and throughout the Great Basin in Utah, Idaho, Nevada, and Oregon to the west. Lake Bonneville was the largest of these ancient lakes at a size similar to Lake Michigan (Behnke 1992). Limestone deposits of the Green River formation and associated fossils from an early inland water body are visible today at Fossil Butte National Monument west of Kemmerer. Through periods of glaciation largely to the north, a connection to the Columbia River system periodically occurred and influenced today's aquatic fauna. For example, Bonneville cutthroat trout are believed to have derived from Yellowstone cutthroat trout immigrants to the Bonneville basin (Behnke 1992).

The Bear River basin occurs on the west side of Wyoming's climate division 3 (Curtis and Grimes 2004). This climate division is the third coolest climate division of the ten climate divisions in Wyoming, warmer only than divisions 1 and 2 to the north. Monthly temperatures range from an average of about 15º F in January to about 63º F in July. The climate is one of the driest in the state, with annual precipitation of only about 10 inches. Peak precipitation occurs in May, while winters are cold and dry, with the exception of snow at bordering mountain high elevations (Curtis and Grimes 2004).

All 11 habitat types defined in this SWAP (e.g., sagebrush shrublands, riparian, etc.,) occur in the watershed and are based on combinations of Ecological Systems (ES) developed by NatureServe (Comer et al. 2003, NatureServe Explorer 2009). The determination and delineation of ES is based on land cover maps produced by the Northwest Gap Analysis Project (NWGAP 2010). Land cover mapping under NWGAP for the Bear River basin in Wyoming is in USGS mapping zone 22 (Wyoming Basins). Of the 173 ES identified under NWGAP, 52 occur in the Bear River basin (excluding developed and open water classes). The most prevalent classes are associated with the sagebrush shrublands (35%), foothills shrublands (28%), and the wetlands (12%) habitat types. The Inter-Mountain Basins Big Sagebrush Steppe is the most common ES in the sagebrush shrublands of the Bear River basin. Associated species assemblages, threats, and conservation actions of this and other habitats in this watershed are addressed in separate SWAP chapters.

Land use includes livestock grazing, timber production, irrigated cropland, energy development (oil, potentially oil shale, natural gas, and wind), trona mining, and recreation (Chapman et al. 2004, Department of Interior 2010). The Kemmerer District of the BLM largely overlaps this basin, and a Resource Management Plan (RMP) was approved in May 2010 to guide management. Livestock grazing is one of the most obvious and long-term land uses in the basin. Crop production includes largely irrigated meadow grass for grazing or hay. Irrigation is almost exclusively via flood irrigation application with relatively small water use via sprinklers (Bear River Basin Water Plan 2001). Development along the Bear River occurs within the municipality of Evanston which relies on treated water from Sulphur Creek Reservoir. The other municipality in the watershed, Cokeville, is near the confluence of the Smiths Fork River and the Bear River, and it derives water from groundwater sources (Bear River Basin Water Plan 2001).

Major reservoirs in the basin upstream of the lowest point on Bear Creek in Wyoming are Sulphur Creek Reservoir and Woodruff Narrows Reservoir with storage of 19,775 acre feet (af) and 57,300 af, respectively. In addition to the large reservoirs, hundreds of stock ponds and many miles of irrigation ditches have been constructed. The total annual runoff in the watershed is about 427,000 af at the Wyoming-Idaho gage (Bear River Basin Water Plan 2001). Runoff patterns are typical of snow-melt dominated systems with high peak flows in late May or early June and lowest annual flows occurring in January or February. The majority of the water produced in the watershed is allocated among users in Wyoming, Idaho, and Utah with little surplus (Bear River Basin Water

Plan 2001). Flows are commonly perennial in the headwaters, particularly those at higher elevations, and low or intermittent flows are common in downstream stream reaches (Waddell et al. 2003).

The Bear River below Sulphur Creek and down to Woodruff Narrows Reservoir, a distance of 36 miles, is threatened by sediment and is on the 303(d) List (Wyoming Department of Environmental Quality 2010). The other impaired water in the basin is a 14.5-mile reach of Bridger Creek, which was identified as a significant contributor of sediment and phosphates to the Bear River above the Twin Creek confluence. Incised channels in erodible soils, due to a variety of land uses (intensive historic grazing practices, road construction, agricultural crop production, phosphate mining, and riparian willow removal by chemical spraying), have created stream bank erosion and sediment challenges in several streams.

Aquatic Wildlife

Fish

Twenty-one fish species, including two subspecies of cutthroat trout and twelve native species, are now found in the Bear River basin (Table 1). The nonnative fish community consists of nine game species, the most common of which are introduced salmonids.

Table 1. Fishes present in the Bear River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*).

Native game	Native nongame	Nonnative game	Nonnative nongame
Bonneville cutthroat trout*	Bluehead sucker*	Brook trout	Common carp
Mountain whitefish*	Longnose dace	Brown trout	
	Mottled sculpin	Green sunfish	
	Mountain sucker	Largemouth bass	
	Northern leatherside chub*	Rainbow trout	
	Paiute sculpin	Smallmouth bass	
	Redside shiner	Snake River cutthroat trout	
	Speckled dace	Walleye	
	Utah chub	Yellow perch	
	Utah sucker		

Simon (1951) surveyed only three sites in the Bear River basin: two on the mainstem Bear River and one on the Smiths Fork. However, combining his sampling with previous work, he documented the presence of 10 of the 12 species now known to be native to the drainage. The taxonomy of the genus Cottus (sculpins) is confusing and has been repeatedly revised. Simon indicated that the species *C. semiscaber* which he called the Rocky Mountain sculpin was present in the Bear River drainage. Today, two species of sculpin, *C. bairdi* and *C. beldingi,* are considered native to the Bear River basin, but it is not clear which of the two was collected by Simon. Simon (1951) also failed to collect bluehead sucker *Catostomus discobolus*.

The historic distribution of native suckers is confounded by changes in taxonomic nomenclature and problems distinguishing the bluehead sucker and mountain sucker *Catostomus platyrhynchus,* both of which were once considered to be members of the genus *Pantosteus* (Gelwicks et al. 2009). The first likely record of bluehead sucker in the basin in Wyoming was reported from the Bear River by Sigler and Miller (1963). Baxter and Simon (1970) documented the presence of bluehead

sucker in the Smiths Fork River, and Wheeler (1997) found a single bluehead sucker in the mainstem Bear River, one of 17 sites that he surveyed in the basin in 1995 and 1996. Bluehead sucker were sampled in several sections of the Smith's Fork River and in the mainstem Bear River as recently 2005 (Craig Amadio and Pete Cavalli, personal communications).

During early surveys by the Wyoming Game and Fish Department (WGFD), some of the native subspecies of cutthroat trout had not yet been described. As a result, Simon (1951) reported sampling Yellowstone cutthroat trout *O. clarkii bouvieri* from the Smiths Fork and concluded that the subspecies may also be native to the Bear River basin. However, it is now accepted that the Bonneville cutthroat trout *O. clarkii Utah* is the only trout native to the Bear River basin. Historic abundance of native cutthroat in the basin was reduced by competition and hybridization with nonnative salmonids, habitat deterioration, and overfishing, to the point that it was believed to be extinct (Sigler and Miller 1963, Baxter and Simon 1970). However, in the 1960s, WGFD biologists began to document observations of a potentially unique cutthroat strain in the basin, and cutthroat trout investigations began in earnest. By the late 1970s, it was widely accepted that the native cutthroat in the Bear River basin was a unique subspecies *Salmo clarki Utah*. Common names for the newly recognized subspecies included Bonneville, Bear River, Utah, and Snake Valley cutthroat trout. Binns (1981) and Duff (1988) provide excellent summaries of the history and status of the newly described subspecies of native cutthroat. Bonneville cutthroat investigations intensified in 2000, and during the next six years, six graduate research projects were completed (Johnstone 2000, Colyer 2002, Schrank 2002, White 2003, Roberts 2004, and Carlson 2006). These theses and subsequent publications (Carlson and Rahel 2007, Colyer et al. 2005, Johnstone and Rahel 2003, Schrank et al. 2003, Roberts and Rahel 2008, White and Rahel 2008) contributed significantly to our current understanding of the status, distribution, and life history of this unique subspecies of native cutthroat. The Bonneville cutthroat has been petitioned for listing under the Endangered Species Act (ESA) on multiple occasions. The most recent finding was issued in September 2008. The U.S. Fish and Wildlife Service concluded that listing was not warranted because "viable, self-sustaining Bonneville cutthroat trout populations are well distributed throughout its historic range and are being restored or protected in all currently occupied watersheds (Federal Register: Sepetember 9, 2008, Vol. 73, Number 175, pp. 52235-52265).

The Bear River basin also constitutes the core of the native range of northern leatherside chub *Lepidomeda copei* (LSC) in Wyoming. The known distribution of native populations of management significance in Wyoming currently consists of a single population in Pacific Creek in the Pacific Northwest watershed and three relatively widespread populations within the Bear River basin. The Bear River populations include 1) the Smiths Fork drainage near Cokeville, 2) the Rock Creek drainage near Fossil Butte National Monument, and 3) the upper Bear River tributary streams south of Evanston. Status is summarized in Zafft et al. (2009), Miller et al. (2009), and Amadio et al. (2009). In 2007, this species was also petitioned for listing under the ESA. As of July 2010, the U.S. Fish and Wildlife Service had not issued a finding.

No native species are known to have been extirpated from the Bear River basin, but introduced brook, brown, and rainbow trout are common. Introduced Snake River cutthroat trout, largemouth bass, smallmouth bass, green sunfish, and yellow perch are rare. Walleye and smallmouth bass were illegally introduced into Sulphur Creek Reservoir where they are successfully reproducing. Green sunfish have been found in a single, private trout pond, Quealy Reservoir. Common carp are abundant in the mainstem Bear River. Largemouth bass and yellow perch have also been found in the mainstem Bear River, but population sizes are unknown.

Aquatic Reptiles
No turtles are native to the Bear River Basin watershed, and none have been introduced.

Freshwater Mollusks and Crayfishes
Few published accounts exist (Beetle 1989, Henderson 1924, Hoke 1979, Hovingh 2004), but native mussel populations are currently present in every major drainage of Wyoming except the Green River and Great Divide basins. Wyoming is still in the discovery phase in terms of its freshwater mussels and gastropods, but the WGFD has intensified sampling efforts in recent years. One biologist on the Aquatic Assessment Crew has been assigned to coordinate mollusk sampling and collect observations. Field personnel have been trained and instructed to record mussel observations during other routine fieldwork and submit specimens. A voucher specimen collection was established at the University of Colorado Natural History Museum in Boulder, Colorado, in 2007.

As of late 2010, seven species of native mussels were known to inhabit Wyoming waters, all of which are considered SGCN. Two of these species, the western pearlshell *Margaritifera falcata* and the California floater *Anodonta californiensis* have been documented in the Bear River watershed (Beetle 1989). The western pearlshell was collected as recently as 2008 from the Bear River (live specimens) and the Smiths Fork (empty shell) immediately north of Cokeville. This species was also collected in 2010 from the upper Bear River near the Utah state line. One shell had tissue attached, documenting recent occurrence (C. Amadio, personal communication). Numerous live California floater, a federal species of concern, were collected in 2010 from the Bear River approximately 10 mi south of Cokeville, Wyoming (G. Edwards, personal communication).

Little is known about the current distribution of Wyoming gastropods. Beetle (1989) contains some of the only published observations in Wyoming, listing species occurrences by county. In 2009, the WGFD funded a project at the University of Wyoming (UW) to conduct a literature review, identifying the current and historical information on freshwater gastropod distributions in Wyoming and to develop gastropod collection methods for WGFD, and assess the distribution of freshwater gastropods in the Bighorn and North Platte river drainages in Wyoming. This project did not include any sampling in the Bear River basin. The UW research project will provide gastropod sampling protocols. Baseline survey data are needed for all gastropods in the Bear River watershed.

The only crayfish species known to be native to the Bear River basin in Wyoming is *Pacifasticus gambelii*. This was the only species found during a 1985–1987 crayfish survey (Hubert 1988). *Orconectes virilis*, a nonnative species, was the only species found in the Bear River drainage during the 2007-2009 survey and appeared to have displaced *P. gambelii* (Hubert 2010).

Table 2. Species of Greatest Conservation Need present in the Bear River Basin

Fish
Bluehead sucker
Bonneville cutthroat
Northern leatherside chub
Mountain whitefish

Crustaceans
Pilose crayfish

Mollusks
California floater mussel
Western pearlshell mussel

Identification of Conservation Areas

The 7,500 sq mi Bear River basin includes portions of northeast Utah, southeast Idaho, and southwest Wyoming. Approximately 20% of the basin lies in Wyoming, The Wyoming Game and Fish Department Strategic Habitat Plan (WGFC 2009) references multiple goals, two of which are to conserve and manage wildlife habitats that are crucial for maintaining

terrestrial and aquatic wildlife populations for the present and future, and to enhance, improve and manage priority wildlife habitats that have been degraded. Crucial habitat areas were identified to accomplish the first, and enhancement areas were identified to accomplish the second. While only 20% of the Bear River basin lies in Wyoming, the entire Wyoming portion of the basin is considered an important conservation area for aquatic SGCN (Figure 2).

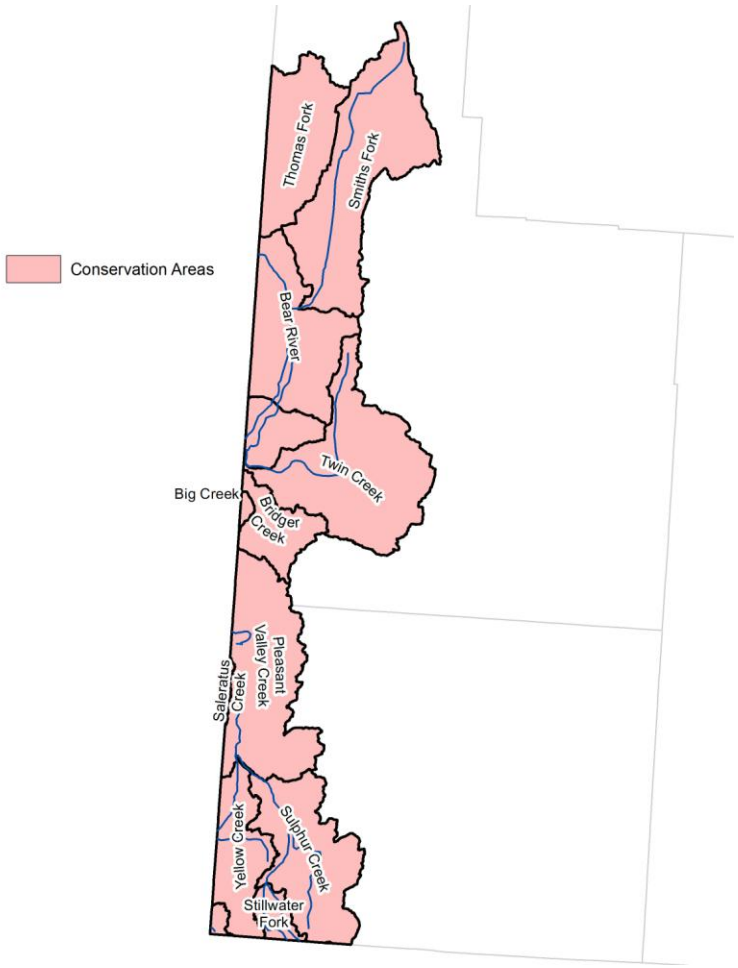

Figure 2. Aquatic Wildlife Conservation Areas in the Bear River Basin

The mainstem Bear River is an important migration corridor for spawning Bonneville cutthroat trout and bluehead suckers have been documented in the river. Major tributaries Twin Creek, Smiths Fork, and Thomas Fork are critical to the conservation of northern leatherside chub, Bonneville cutthroat trout or both. The headwater tributaries of Mill, LaChapelle, and Sulphur creeks draining the north slope of the Uinta Mountains are critical for northern leatherside chub. Wyoming's efforts to conserve Bonneville cutthroat trout and northern leatherside chub in the basin have contributed significantly to keeping these two species from listing under the ESA. Conservation areas are likely to be further refined upon completion of the northern leatherside chub project described below.

Threats

Ungulate grazing and browsing – High
On a landscape scale, livestock grazing is the primary factor currently and historically influencing habitats in the Bear River basin.

Stream habitat conditions are below potential because of eroded stream banks and high sediment levels contributed by degraded plant communities. Herbicide spraying in the 1960s and long-term heavy grazing have severely impacted willow communities. Proper stocking levels and grazing regimes can be effective habitat management tools and are compatible with stream channel, riparian, and upland area maintenance and improvement. However, improper grazing can eliminate vegetation and associated wildlife, widen stream channels, cause soil erosion, increase water sediment loads, raise water temperature, encourage the spread of invasive plan species, change bank configuration, and lower surrounding water tables (Chaney et al. 1991, Nicholoff 2003). Overbrowsing by wildlife, particularly elk and moose, can also have similar negative effects. As with livestock grazing, impacts tend to be site specific, where herd numbers exceed management objectives, or where animals congregate to escape hunting and other forms of predation, or as a result of other causes.

Water development/altered flow regimes – Moderate

Natural flow regimes in stream segments around the state have been altered by human activities including irrigation diversions and water developments for more reliable water supply, hydropower, and flood control. These altered flow regimes are also a consequence of broad-scale changes in land use and management associated with agriculture, grazing, timber harvest, and housing development (see Wyoming Leading Wildlife Conservation Challenges – Disruption of Historic Disturbance Regimes). The majority of the Bear River basin is publically owned. Because it is such an arid region the limited amount of irrigated cropland has a significant impact on aquatic wildlife. In addition, the direct effects of dewatering the irrigation diversions impede movement, and some fish are lost to entrainment into the irrigation ditches. Lateral and longitudinal hydrologic connectivity and physical access by fish populations to all habitats necessary to complete their life history is limited throughout the drainage. In-channel obstructions and dewatering have reduced some populations of native fishes.

The need for additional water for human use will intensify in the immediate future, and that trend will be especially evident in the western U.S. This trend has multi-faceted consequences for fish and wildlife and the habitats upon which they depend. In Wyoming, trans-basin water diversions are not uncommon and are likely to be further proposed and pursued. Energy diversification, including hydropower development, may increase as the nation's energy demands rise. Warmer conditions with more erratic precipitation— which some predict for Wyoming's future climate—may heighten the need for additional water development (water storage) for municipal and agricultural purposes. The likely trend will be water development projects closer to the delivery point and conveyance via pipelines instead of stream channels. Additional emphasis will likely be placed on lining irrigation ditches and other practices to more efficiently use water for consumptive purposes. The net effect of all such water management practices will be to alter the timing, magnitude and duration of natural hydrographs and reduce intra- and inter-annual variability in Wyoming's streams and associated riparian corridors (see Wyoming Leading Wildlife Conservation Challenges – Climate Change, and the Riparian habitat chapter).

Two assessments of additional water storage have been conducted recently in this basin. The Cokeville Reservoir Study includes the construction of a dam in the Smiths Fork River (RJH Geotechnical and Water Resources Engineering 2010). The Sublette Creek Reservoir Mau / Covey Canal Rehabilitation Project proposes additional water development options in the Smiths Fork drainage (Sunrise Engineering, Inc. 2004). Projects under both studies would impede upstream migration of native fish and reduce stream flow.

Drought and climate change – Moderate

Climate change may increase air and surface water temperatures, alter the magnitude and seasonality of precipitation and runoff, and shift the reproductive phenology and distribution of

plants and animals (Seavy et al. 2009) (see Wyoming Leading Wildlife Conservation Challenges – Climate Change).

Changes in precipitation patterns under various climate change scenarios are predicted to produce peak flows earlier in the yearly cycle and to lower base flows (Barnett et al. 2004, Gray and Anderson 2009). Drought lowers water tables, leading to reduced plant growth and reproduction. Riparian vegetation declines lead to lower bank stability, higher siltation and altered stream habitat quality and quantity. Lower water levels increase water temperatures and reduce the living space available to fish and other aquatic wildlife. All these conditions can be detrimental to the health and reproductive success of all aquatic wildlife species.

Invasive species – Moderate
Competition, predation, and hybridization with nonnative trout is a concern within the Bear River watershed but these threats have not eliminated any native species. Piscivorous fish, including brown trout, yellow perch and walleye prey upon native nongame fish. Populations of walleye, smallmouth bass, brook trout and rainbow trout located in the Wyoming portions of this watershed threaten native fish.

Aquatic invasive species (AIS) including fish, pathogens, plants, and mollusks are currently present in Wyoming, most notably the New Zealand mudsnail and the parasite that causes whirling disease. These AIS can alter the native species in a watershed through competition, disease, shifts in food availability, and direct mortality. While AIS currently in Wyoming can cause problems and need to be controlled, the most significant known threat to Wyoming's native species is from zebra and quagga mussels, based on their proximity to Wyoming and demonstrated negative impacts in other areas. Zebra and quagga mussels can out-compete native mussels for space and resources and will attach to and smother native mussels causing mortality (Cummings and Mayer 1992, Strayer 2008). They filter plankton out of the water column at high rates (up to a liter per day per individual) so that little plankton remains available for fish populations, resulting in their decline (Benson 2009). In addition, invasive mussels produce pseudofeces which can lead to harmful algal blooms affecting numerous aquatic species.

The Wyoming Aquatic Invasive Species Act of 2010 allowed the WGFD to implement the Wyoming AIS Program with the goal of executing a coordinated strategy to prevent, control, contain, monitor, and whenever possible, eradicate aquatic invasive species from the waters of the state. The Wyoming AIS Management Plan of 2010 is the framework for this three-part strategy which includes 1) outreach and education, 2) inspection of watercraft to increase boater awareness of AIS threats and prevention and to intercept high risk watercraft that may be transporting AIS, and 3) monitoring of waters to allow for early detection and rapid response to any new AIS populations in the state.

Conservation Initiatives

Since 2005, numerous conservation planning efforts have been conducted by the WGFD, federal agencies, and conservation groups to benefit SGCN in the Bear River basin. Partners continue to work together to follow management activities specified in Conservation Agreement and Strategy plans for Bonneville cutthroat trout (May and Albeke 2005), bluehead sucker (Utah Division of Wildlife Resources 2006), and the northern leatherside chub (Utah Division of Wildlife Resources 2009). The Nature Conservancy, working with numerous cooperators, recently completed a Conservation Action Plan for the Bear River drainage, and the U.S. Fish and Wildlife Service is currently drafting a management plan for the Cokeville Meadows National Wildlife Refuge.

Fish passage has been a priority in the watershed, and research and planning efforts have led to a number of projects to address passage issues. The U.S. Bureau of Land Management recently completed a survey of road culverts that are acting as fish barriers in western Wyoming and eastern Utah. Several

irrigation diversions have been modified to allow fish passage and eliminate entrainment into canals. These projects include diversions on Coal Creek, Grade Creek, and several diversions on Rock Creek. In addition, the amount of water diverted on Grade Creek has been reduced, allowing water to flow once more through a section of stream that had been dry for several decades. Diversions on Twin Creek and the Smiths Fork River are currently being evaluated for future modification. Cooperators on various passage projects include Trout Unlimited, the WGFD, the U.S. Forest Service, and private land owners.

WGFD studies of relationships between flow and habitat for Bonneville cutthroat trout have been extensive in parts of the Bear River basin. From these studies, 17 instream flow water rights have been filed by the WGFD and Wyoming Water Development Office and permits approved by the State Engineer. These instream flow water rights permits protect 41 miles of streams in the Smiths Fork and Thomas Fork drainages (Paul Dey, personal communication).

Riparian habitat improvement has also been a priority. The WGFD and other organizations are currently pursuing conservation easements on several important tracts of private land in the Smiths Fork and Bear River drainages. Recent habitat improvement projects in the Thomas Fork drainage have included willow plantings, grazing exclosures and head cut stabilization. Plans are currently being developed to improve roads to reduce sediment loading to streams.

WGFD aquatic habitat personnel work closely with the BLM to improve watershed health with an emphasis on riparian and aquatic habitats. Cooperative efforts include assisting the BLM and permittees with maintenance of pasture fences and riparian exclosures and extensive coordination with BLM range and wildlife personnel to monitor annual use and distribution of livestock. Furthermore, to provide additional information to support the BLM's 2001 allotment evaluation, a range suitability analysis was performed using a GIS based rangeland suitability tool (Oberlie and Bishop 2009). A settlement agreement between the BLM and other parties on an appeal of the 2005 Allotment Management Plan has the BLM consulting with WGFD to develop Bonneville cutthroat trout habitat objectives. Finally, riparian greenline data are being cooperatively collected with the BLM.

Cooperative grazing management with the Kemmerer Ranger District of the Bridger-Teton National Forest is likewise an area of ongoing effort by the WGFD. The WGFD has provided assistance and input into allotment management plan development, implementation, and monitoring.

Two large-scale status assessment projects funded by the State Wildlife Grants (SWG) are being initiated to address SGCN in the Bear River basin. The first project was initiated in 2010 to determine the current distribution of northern leatherside chub (LSC) in Wyoming. The distribution of this species is primarily within the Bear River drainage in Wyoming. The objectives of this project are to 1) determine baseline abundances for major populations of LSC in Wyoming, 2) identify species of fish sympatric with LSC in Wyoming, 3) identify relationships between LSC distributions and habitat characteristics, and 4) collect tissue samples from major LSC populations in Wyoming for genetic analyses. Brigham Young University (BYU) and Idaho State University (ISU) researchers are also conducting LSC research in the basin and are coordinating efforts with WGFD biologists. A BYU project will address objective 3 above. The genetic analysis (objective 4 above) will be completed as part of a master's degree project through ISU, which was funded by the Wyoming Governor's office.

The second project will be initiated in spring 2011 to determine baseline distributions and status of freshwater mussel species in the Bear and Snake/Salt River basins in Wyoming. The specific objectives of this project are to 1) establish mussel distribution and habitat survey methods appropriate for use throughout Wyoming, 2) establish species distributions and identify core populations of mussels, 3)

contribute to a comprehensive collection of mussel voucher specimens at the University of Colorado Museum, and 4) evaluate the need for population monitoring and propose management recommendations.

The states of Utah, Nevada, Wyoming, and Idaho, and the U.S. Forest Service, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, Confederated Tribes of the Goshute Reservation, and Utah Reclamation Mitigation and Conservation Commission are signatories to a range-wide conservation agreement and strategy for Bonneville cutthroat trout. This agreement was implemented to ensure the long-term survival of the subspecies through coordination of conservation efforts among the signatory agencies (BRC Conservation Team 2000). Under the auspices of this plan, numerous conservation actions have been planned and implemented through state and federal conservation and management plans. A Bonneville Cutthroat Trout Conservation Team was formed as part of that plan. The team includes biologists from the Wyoming Game and Fish Department, Utah Division of Wildlife Resources, Nevada Division of Wildlife, Idaho Department of Fish and Game, Bureau of Land Management, U.S. Forest Service, the National Park Service, and the U.S. Fish and Wildlife Service. The team completed a status report (May and Albeke 2005) that describes the range-wide status of Bonneville cutthroat trout in the United States.

An active conservation and management program for northern leatherside chub has developed in the last several years. One of the most important recent accomplishments is that the states of Idaho, Nevada, Utah, and Wyoming along with the U.S. Forest Service, Bureau of Land Management, Bureau of Reclamation, National Park Service, Fish and Wildlife Service, Trout Unlimited and The Nature Conservancy, signed a conservation agreement to jointly conserve, protect, and restore northern leatherside populations within their historic range (BRC Conservation Team 2009). This agreement has already begun advancing range-wide conservation and management efforts.

The WGFD's Fish Division has developed basin management plans to guide management across the state. These plans provide background and history of aquatic wildlife management as well as management direction for sportfish, SGCN, and aquatic habitat. The management direction includes reference to the SWAP and the Strategic Habitat Plan, attempting to incorporate management direction from those two plans that is relevant to each basin into each basin management plan.

The WGFD has the opportunity to comment on most environmentally sensitive construction or management actions submitted through the National Environmental Policy Act (NEPA) review process. Projects include state and federal lands and private ventures that require action by state or federal agencies. The WGFD regularly provides recommendations to protect habitat and populations of aquatic wildlife at the project level. Department efforts are guided by the Wyoming Game and Fish Commission mitigation policy (WGFC 2008).

The WGFD has a rigorous collection permitting system that restricts commercial, scientific, and educational activities (WGFC 2005) and provides protection to aquatic wildlife. The regional fisheries supervisor reviews all requests for permits and recommends either approval or rejection of the request based on merit and impacts to the resource in question.

The movement of fish by WGFD employees is critical to address many of the aspects, thus the intent, of our mission. However, the act of moving or importing fish also presents risks that could potentially jeopardize that mission. To address this conflict, a method to determine the relative level of risk associated with any proposed fish importation and/or transplant was developed. The WGFD utilizes Hazard Analysis and Critical Control Point (HACCP) procedures (Gunderson and Kinnunen 2001) and has developed a risk assessment matrix from these procedures to manage transplants, thereby protecting the aquatic resources within

the state. Using the procedures and matrix, WGFD fisheries managers develop documentation that explains whether a transplant is nearly free of risk. The documentation must address all aspects of the transplant, including but not limited to verifying that the fish being transplanted are disease free, the water source is disease free, and non-target species are excluded from transplant. Source populations of salmonids are verified disease free by collecting a standardized number of fish, having them inspected by an American Fisheries Society-certified Fish Health Inspector for all known pathogens, and receiving disease-free certification. The resulting documentation is reviewed and either approved or denied by the WGFD Chief of Fisheries. Whirling disease-infected trout, native or nonnative, are not stocked by the WGFD, and they are not allowed to be stocked by others (WGFC 2003).

In Wyoming, Game and Fish Commission policy precludes the stocking of fish into waters that are capable of maintaining satisfactory, self-sustaining fisheries (WGFC 1998). A commonsense, biologically based protocol for fish rearing and stocking has historically been followed in Wyoming, with emphasis on management for native fish and wild fish wherever possible (Wiley 1995). Only 3% of the streams listed in the Wyoming Game and Fish Department database inventory are stocked annually. Maintenance of native cutthroat trout subspecies has been a management priority for more than 40 years (Stone 1995), and protection from stocked predators of native nongame fishes has been an important consideration for at least the last decade.

Wyoming has regulations prohibiting unauthorized stocking of fish or fish eggs. Private citizens can only stock waters in Wyoming following a WGFD permitting system that includes review by the responsible regional fisheries supervisor (WGFC 2005). WGFD has increased public education efforts regarding problems associated with illegal introductions of fish. The Wyoming Legislature increased the penalties for illegal fish stocking in 2010, and the Wyoming Wildlife Protectors Association has offered $2,500 rewards for information leading to the conviction of individuals found illegally moving or stocking fish.

Habitat management efforts are guided by the Strategic Habitat Plan (SHP) that was adopted by the Wyoming Game and Fish Commission in January 2009. The SHP includes five goals: 1) Conserve and manage wildlife habitats that are crucial for maintaining terrestrial and aquatic wildlife populations for the present and future, 2) Enhance, improve, and manage priority wildlife habitats that have been degraded, 3) Increase wildlife-based recreation through habitat enhancements that maintain or increase productivity of wildlife, 4) Increase public awareness of wildlife habitat issues and the critical connection between healthy habitat and abundant wildlife populations, and 5) Promote collaborative habitat management efforts with the general public, conservation partners, private landowners, and land management agencies. Efforts are focused in priority areas in each of the management regions and include crucial areas essential for conservation of important species and communities, and enhancement areas, which represent places where work should be conducted to manage or improve wildlife habitat.

The Wyoming Legislature created the Wyoming Wildlife and Natural Resource Trust (WWNRT) in 2005. Funded by donations, legislative appropriation, and interest earned on a permanent account, the purpose of the program is to enhance and conserve wildlife habitat and natural resource values throughout the state. Any project designed to improve wildlife habitat or natural resource values is eligible for funding. The WWNRT is an independent state agency governed by a nine-member citizen board appointed by the Governor. The WGFD has partnered with the WWNRT to successfully implement a wide range of projects to benefit a broad array of Wyoming's wildlife.

Landscape Conservation Cooperatives (LCCs) are a new program of the U.S. Fish and Wildlife Service. The vision is that they serve as applied conservation science partnerships focused on a defined geographic area that inform on-the-

ground strategic conservation efforts at landscape scales. LCC partners include U.S. Department of Interior agencies, other federal agencies, states, tribes, non-governmental organizations, universities, and other stakeholders. It is hoped that LCCs will enable resource management agencies and organizations to collaborate in an integrated fashion within and across landscapes. LCCs are intended to provide scientific and technical support to inform landscape-scale conservation using adaptive management principles. They are proposed to engage in biological planning, conservation design, inventory and monitoring program design, and other types of conservation-based scientific research, planning, and coordination. It is hoped that LCCs will play an important role in helping partners establish common goals and priorities, so they can be more efficient and effective in targeting the right science in the right places. Products developed by LCCs should inform the actions of partners and other interested parties in their delivery of on-the-ground conservation. The WGFD will continue to participate in the LCC process as appropriate.

The National Fish Habitat Action Plan (NFHAP) was developed by a coalition of fisheries professionals, state and federal agencies, tribes, foundations, conservation and angling groups, businesses, and industries, all determined to reverse the declines of America's fish habitats. In its design, the plan encompasses five important lessons that emerge from America's past efforts to protect and restore fish habitat: 1) Be strategic rather than merely opportunistic, 2) Address the causes of and processes behind fish habitat decline, rather than the symptoms, 3) Provide increased and sustained investment to allow for long-term success, 4) Monitor and be accountable for scientifically sound and measurable results, and 5) Share information and knowledge at all levels from local communities to Congress. The Wyoming Game and Fish Department has been heavily involved with the development and implementation of the NFHAP. WGFD is involved with three NFHAP partnerships, Great Plains Fish Habitat Partnership, the Western Native Trout Initiative, and the Desert Fishes Habitat Partnership. The latter two cover the Bear River basin.

The mission of the Western Native Trout Initiative (WNTI) is: "To serve as a key catalyst for the implementation of conservation or management actions, through partnerships and cooperative efforts, resulting in improved species status, improved aquatic habitats, and improved recreational opportunities for native trout anglers across western states." Their vision is: "An increase in healthy, fishable western native trout populations resulting from sharper focus and commitment to action on common conservation needs of western native trout; enhanced public benefit resulting from multiple partners working together, sharing resources, and speaking with a united voice about the conservation and value of western native trout; and increased funding to accomplish strategic actions as a result of greater community and financial support from initiative partners and collaborators." By working together, the partners in WNTI are striving to implement the most strategic actions needed to benefit these trout. And by working together to establish secure populations, WNTI will also benefit anglers by enhancing recreational fishing opportunities for unique trout species across the West.

The Desert Fish Habitat Partnership's purpose is to conserve aquatic habitat in the arid west for desert fishes for the American people by protecting, restoring, and enhancing these unique habitats in cooperation with, and in support of, state fish and wildlife agencies, federal agencies, tribes, conservation organizations, local partners, and other stakeholders. The Desert Fish Habitat Partnership seeks to address fish and habitat issues over a broad geographic area that encompasses the entirety of the Great Basin and Mohave deserts, and those portions of the Sonoran and Chihuahuan deserts that lie within the United States. The benefits of aquatic habitat conservation extend beyond desert fishes to include humans and other animal and plant species. Riparian habitats that depend on

surface water not only support a significant number of terrestrial and avian species identified as priority conservation species in SWAPs, but also function to store water that supplements groundwater recharge. The declining status of so many desert fishes highlights the importance of preserving these aquatic habitats so that water is available not only for the native fish, but also for future generations of humans. The Partnership can play an important role in conserving water in the West for future generations.

Recommended Conservation Actions

Secure and enhance populations and habitats in SGCN priority areas.
Evaluate the feasibility of reducing populations of or removing nonnative fishes from priority conservation areas in the basin.

Monitor the status and distribution of native aquatic wildlife assemblages with emphasis on Bonneville cutthroat trout, bluehead sucker, and northern leatherside chub.
Continue basin-wide surveys to identify fish distribution, relative abundance, and habitat preferences.

Beginning in 2010, assist the SWG LSC biologist with project development and data collection.

Assist Mark Belk (BYU) and John Henderson (BLM) with BYU LSC research project development and data collection.

Further explore the status of bluehead sucker in the basin.

Represent the WGFD on the interagency northern leatherside chub conservation team and help implement the Range-wide Conservation Agreement and Strategy for Northern Leatherside.

Represent the WGFD on the interagency Bonneville cutthroat trout conservation team and help implement the Range-wide Conservation Agreement and Strategy for Bonneville cutthroat trout.

Assess the genetic purity of Bonneville cutthroat trout, bluehead sucker, and northern leatherside chub populations.
Collect and store tissue samples from individual populations for future genetic analysis.

Provide funding from BLM sensitive species grant to develop micro-satellite genetic markers for LSC.

Identify and reduce threats to native fish populations from nonnative species.
Monitor walleye, yellow perch and smallmouth bass distribution within the drainage.

Conduct annual monitoring of the Sulphur Creek Reservoir fish populations with trout and walleye gillnetting efforts in June to assess stocking strategies and walleye predation effects on trout abundance.

Continue to investigate opportunities to chemically remove the walleye and smallmouth bass populations from Sulphur Creek Reservoir.

Increase educational efforts about the ecological, economic, and social values of aquatic SGCN.
The importance and role of aquatic SGCN is poorly understood by the general public. Efforts should be enhanced to increase public education in this area.

Continue building voucher collections for all aquatic wildlife.
Continue to fill voids in voucher inventory for fish per WGFD protocol (Zafft and Bear 2009).

Mussel specimens have been donated to the University of Colorado Museum, and new specimens will be added as needed. A database containing freshwater mussel occurrences will be maintained and enhanced with specimen photos.

Determine if there is a museum interested in voucher specimens of gastropods. If so, expand the voucher program to include those organisms.

Complete the comprehensive survey for freshwater mussels.
Future efforts will focus on filling gaps in distribution information, initiating comprehensive drainage surveys, maintaining WGFD records, and expanding specimen collections.

Continue aquatic habitat work in the basin.
Supply flow or other information to the State Engineer's Office and Water Development Office to facilitate adjudication of instream flow water rights.

Monitor instream flow segments for compliance with approved instream flow levels. Pursue compliance as needed when water is available and in priority.

Identify, prioritize, and pursue fish passage solutions on Twin Creek, Smiths Fork, Thomas Fork, Bear River and their tributaries to improve adult trout access to headwater spawning areas and downriver connection to overwintering habitat.

Prioritize and screen irrigation diversions on Twin Creek, Smiths Fork, and Thomas Fork and their tributaries to reduce fish loss.

Identify whether and where passage or screening issues are relevant for northern leatherside chub conservation. Where appropriate, take action to resolve identified problems.

Assist the BLM with monitoring riparian greenline transects and tracking progress toward attainment of Smiths Fork Allotment Management Plan goals.

Continue protecting and enhancing riparian willow communities in the Twin Creek, Smiths Fork, and Thomas Fork watersheds.

Explore water management approaches that enhance fish habitat.
Identify opportunities to work with private water right holders to manage water diversions and uses with the goal of restoring natural flow regimes. Where opportunities exist, develop cooperative strategies with landowners and other partners to implement strategies that are beneficial to aquatic resources.

Identify stream segments where habitat and available flow regimes indicate a need to file instream flow water rights for SGCN. As opportunities are identified, conduct needed studies and file for state-held instream flow water rights.

Identify fish and wildlife mitigation for new reservoirs as they are built including instream flow regimes and minimum fishery pools. Ensure that mitigation recommendations are included as conditions in applicable permits and licenses.

Follow up on recommendations from the graduate research project on gastropods.
The WGFD-funded graduate project at the University of Wyoming will provide direction for sampling methods. Those recommendations should be followed, and baseline gastropods surveys should be conducted in the Bear River basin.

Monitoring

Establish standardized monitoring protocols and locations for native SGCN.
Establish a standardized fish sampling program at multiple sites in the Bear River drainage to follow up on the northern leatherside chub project.

Monitor seasonal flow regimes and temperature in areas containing important native SGCN populations and lacking active USGS or other recording stations.

Use flow and water quality monitoring data to further define the specific life stage needs of leatherside chub for further use in instream flow water right studies.

Monitor the establishment and spread of invasive species. Take action to avoid their introduction and minimize their spread if and when they are documented.

Continue to monitor populations of Bonneville cutthroat trout and northern leatherside chub.

Monitor populations of walleye and smallmouth bass in Sulphur Creek Reservoir in case circumstances change and allow removal efforts to be completed.

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